FIG.1

10 CDMA TRANSMISSION APPARATUS

11 SPREADING CODE GENERATION

12 MAPPING

TRANSMISSION DATA

14 SYMBOL COPY

15 MULTIPLICATION

16 FILTER

17 QUADRATURE MODULATION

FIG.2

20 CDMA RECEPTION APPARATUS

21 SPREADING CODE GENERATION

23 QUADRATURE DEMODULATION

24 FILTER

26 MULTIPLICATION

27 INTER-SYMBOL ADDITION

28 DEMAPPING

RECEPTION DATA

FIG.3

100 SPREADING CODE GENERATING APPARATUS

101 CALCULATION

102 $e^{j(2n\pi/N)}$ CODE LENGTH SETTING

103 CODE NUMBER SETTING

104 CHIP NUMBER SETTING

105 n=a×b CALCULATION

FIG.4

ST0 START

ST1 SET CODE LENGTH N (ARBITRARY NATURAL NUMBER)

ST2 CODE NUMBER

ST3 CHIP NUMBER

ST5 CALCULATE $C(a,b)=e^{j(2n\pi/N)}$

ST6 OUTPUT C(a,b)

END

FIG.5

200 CDMA TRANSMISSION APPARATUS

201 SPREADING CODE GENERATION

202 MAPPING

TRANSMISSION DATA

204 SYMBOL COPY

205 MULTIPLICATION

206 FILTER

207 QUADRATURE MODULATION

FIG.6

300 CDMA RECEPTION APPARATUS

301 SPREADING CODE GENERATION

303 QUADRATURE DEMODULATION

304 FILTER

306 MULTIPLICATION

307 INTER-SYMBOL ADDITION

308 DEMAPPING

RECEPTION DATA

FIG.7A~FIG.7C

SPREADING CODE

FIG.9

400 SPREADING CODE GENERATING APPARATUS

401 $e^{j(2f(n)n/N)}$ CALCULATION

102 CODE LENGTH SETTING

103 CODE NUMBER SETTING

104 CHIP NUMBER SETTING

105 n=a×b CALCULATION

FIG.10

500 CDMA TRANSMISSION APPARATUS

501 SPREADING CODE GENERATION

202 MAPPING

TRANSMISSION DATA

204 SYMBOL COPY

205 MULTIPLICATION

206 FILTER

207 QUADRATURE MODULATION

FIG.11

600 CDMA RECEPTION APPARATUS

601 SPREADING CODE GENERATION

303 QUADRATURE DEMODULATION

304 FILTER

306 MULTIPLICATION

307 INTER-SYMBOL ADDITION

308 DEMAPPING

RECEPTION DATA

FIG.12

700 CDMA TRANSMISSION APPARATUS

701 SCRAMBLING CODE GENERATION

702 MULTIPLICATION

501 SPREADING CODE GENERATION

202 MAPPING

TRANSMISSION DATA

204 SYMBOL COPY

205 MULTIPLICATION

206 FILTER

207 QUADRATURE MODULATION

FIG.13

800 CDMA RECEPTION APPARATUS

801 SCRAMBLING CODE GENERATION

802 MULTIPLICATION

601 SPREADING CODE GENERATION

303 QUADRATURE DEMODULATION

304 FILTER

306 MULTIPLICATION

307 INTER-SYMBOL ADDITION

308 DEMAPPING

RECEPTION DATA

FIG.14

3-factor SPREADING

6-factor SPREADING

9-factor SPREADING

12-factor SPREADING

15-factor SPREADING

18-factor SPREADING

FIG.15

900 CDMA TRANSMISSION APPARATUS

TRANSMISSION DATA #1

202A MAPPING #1

206 FILTER

207 QUADRATURE MODULATION

FIG.16

1000 CDMA RECEPTION APPARATUS

303 QUADRATURE DEMODULATION

304 FILTER

308a DEMAPPING #1

RECEPTION DATA #1

FIG.17

1100 CDMA RECEPTION APPARATUS

15-factor SPREADING

9-factor SPREADING

3-factor SPREADING

TRANSMISSION DATA #1

202 MAPPING #1

1101 FIVE-POINT IDFT

1102 1103 THREE-POINT IDFT

206 FILTER

207 QUADRATURE MODULATION

FIG.18

1200 CDMA RECEPTION APPARATUS

1201 1203 THREE-POINT DFT

1202 FIVE-POINT DFT

303 QUADRATURE DEMODULATION

304 FILTER

308 DEMAPPING #1

RECEPTION DATA #1

15-factor SPREADING

9-factor SPREADING

3-factor SPREADING

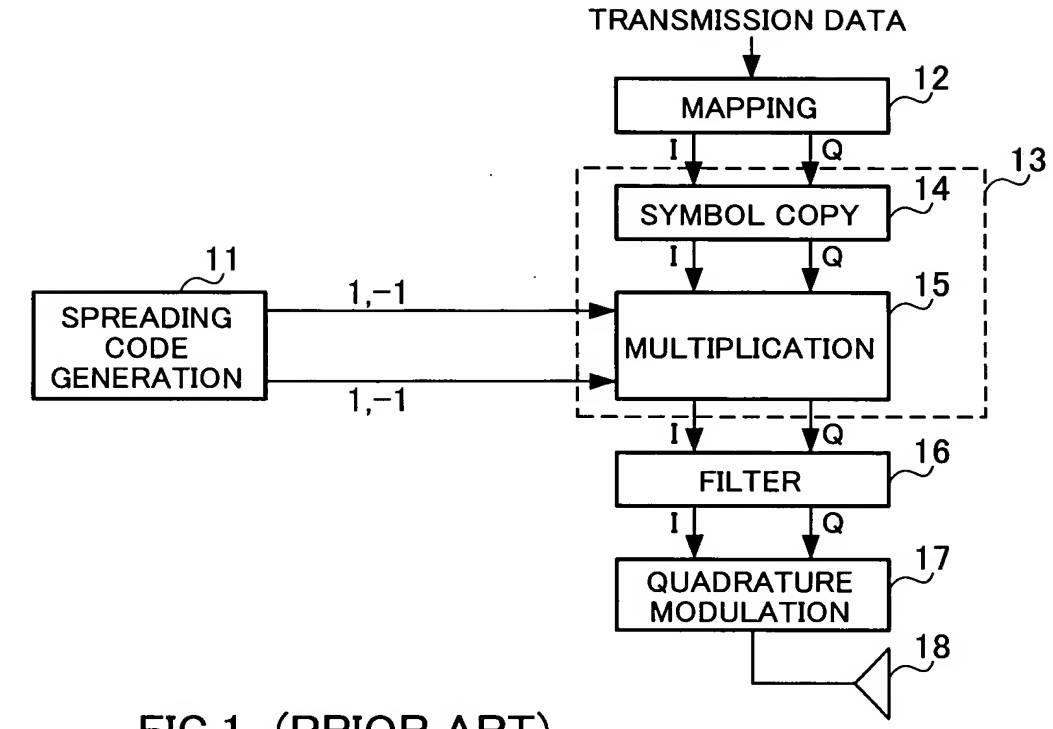


FIG.1 (PRIOR ART)

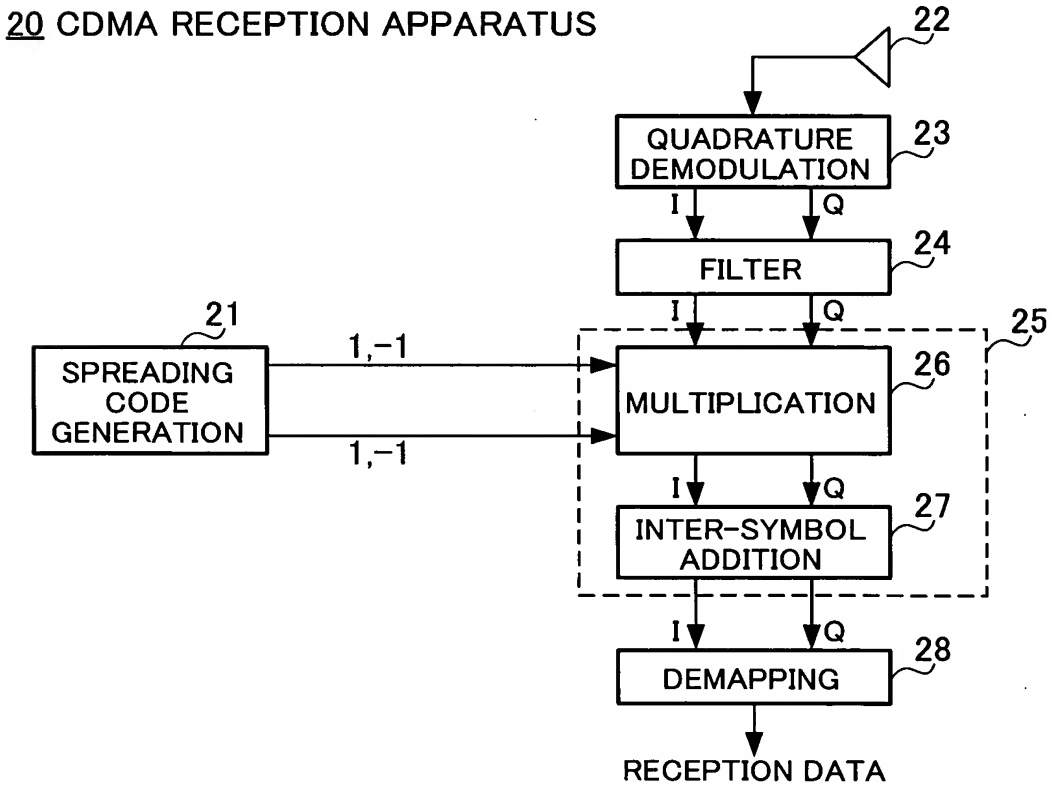


FIG.2 (PRIOR ART)

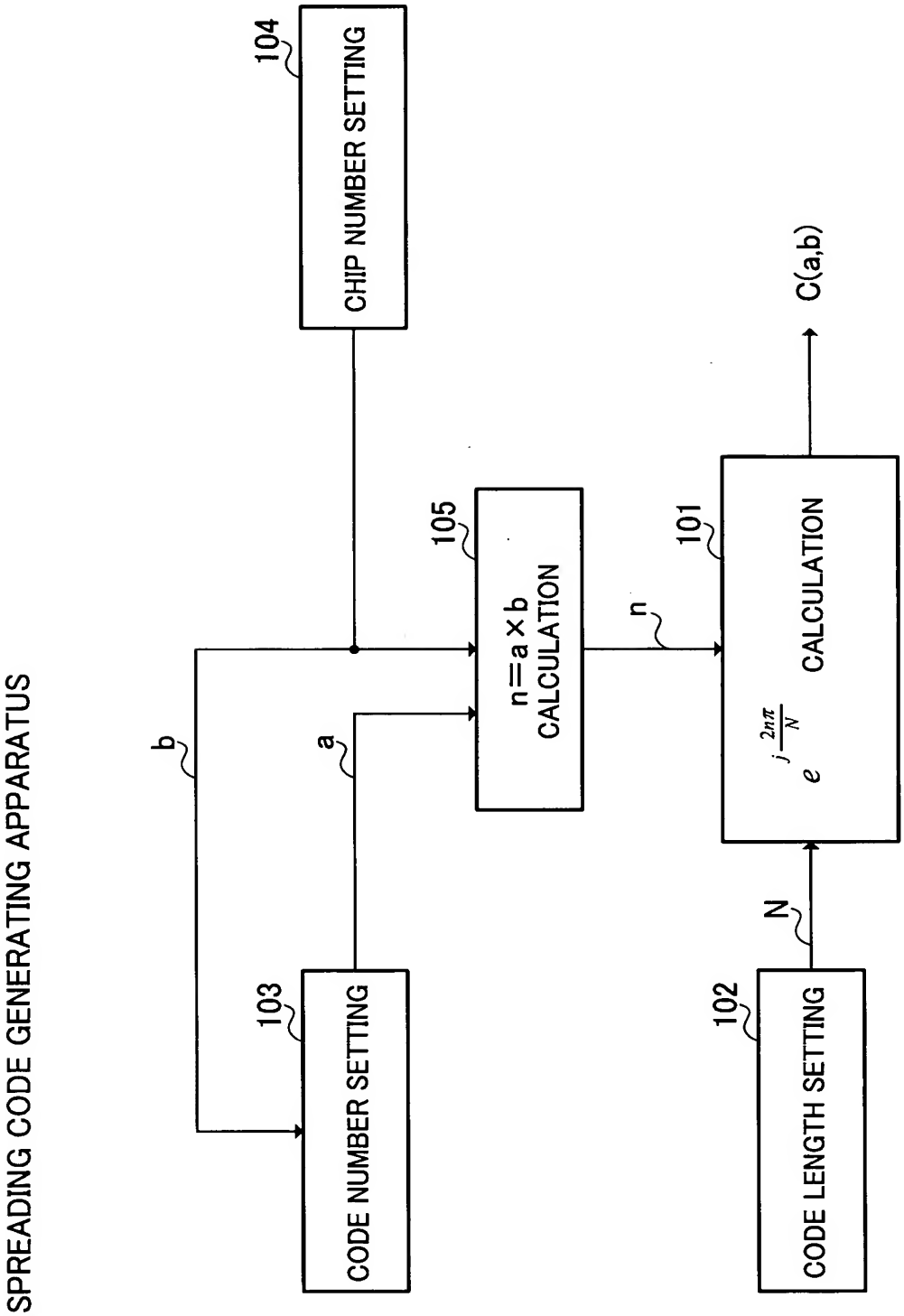

100 SPREADING CODE GENERATING APPARATUS
104
CHIP NUMBER SETTING
105
n=a×b
CALCULATION
101
CALCULATION
C(a,b)
n
b
a
103
CODE NUMBER SETTING
102
CODE LENGTH SETTING
N

FIG.3

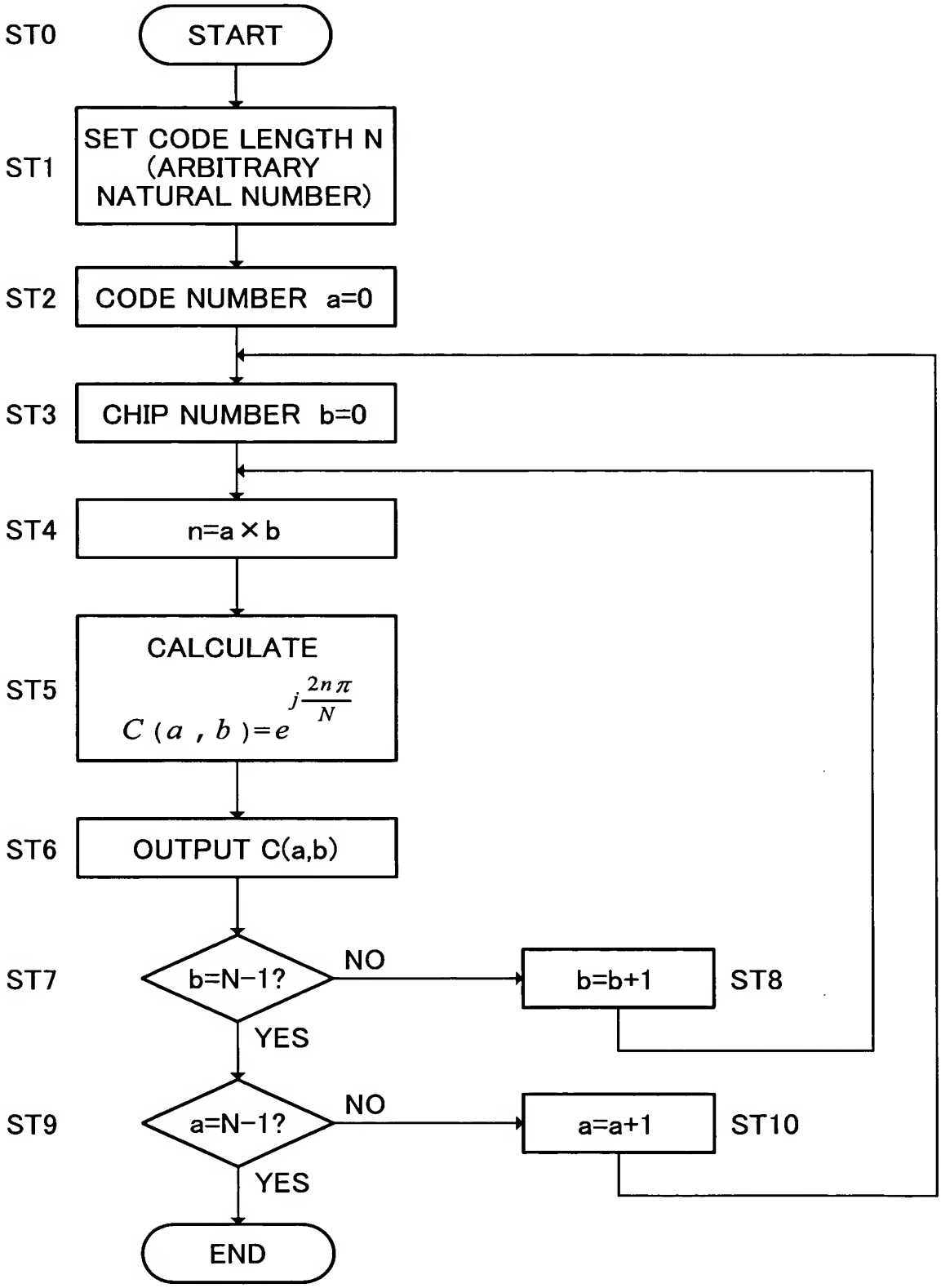

ST0
START
ST1
SET CODE LENGTH N (ARBITRARY NATURAL NUMBER)
ST2
CODE NUMBER a=0
ST3
CHIP NUMBER b=0
ST4
n=a×b
ST5
CALCULATE
$C(a,b)=e^{j\frac{2n\pi}{N}}$
ST6
OUTPUT C(a,b)
ST7
b=N-1?
NO
b=b+1
ST8
YES
ST9
a=N-1?
NO
a=a+1
ST10
YES
END

FIG.4

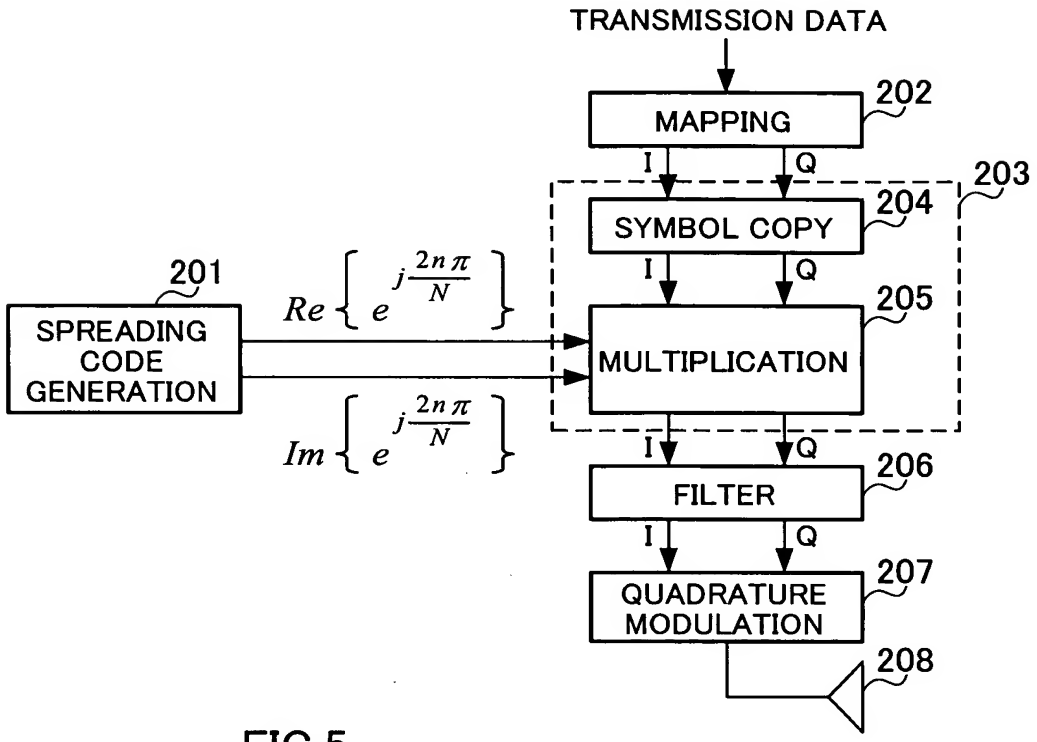

200 CDMA TRANSMISSION APPARATUS
TRANSMISSION DATA
MAPPING
202
I
Q
203
SYMBOL COPY
204
201
SPREADING CODE GENERATION
Re
Im
MULTIPLICATION
205
FILTER
206
QUADRATURE MODULATION
207
208

FIG.5

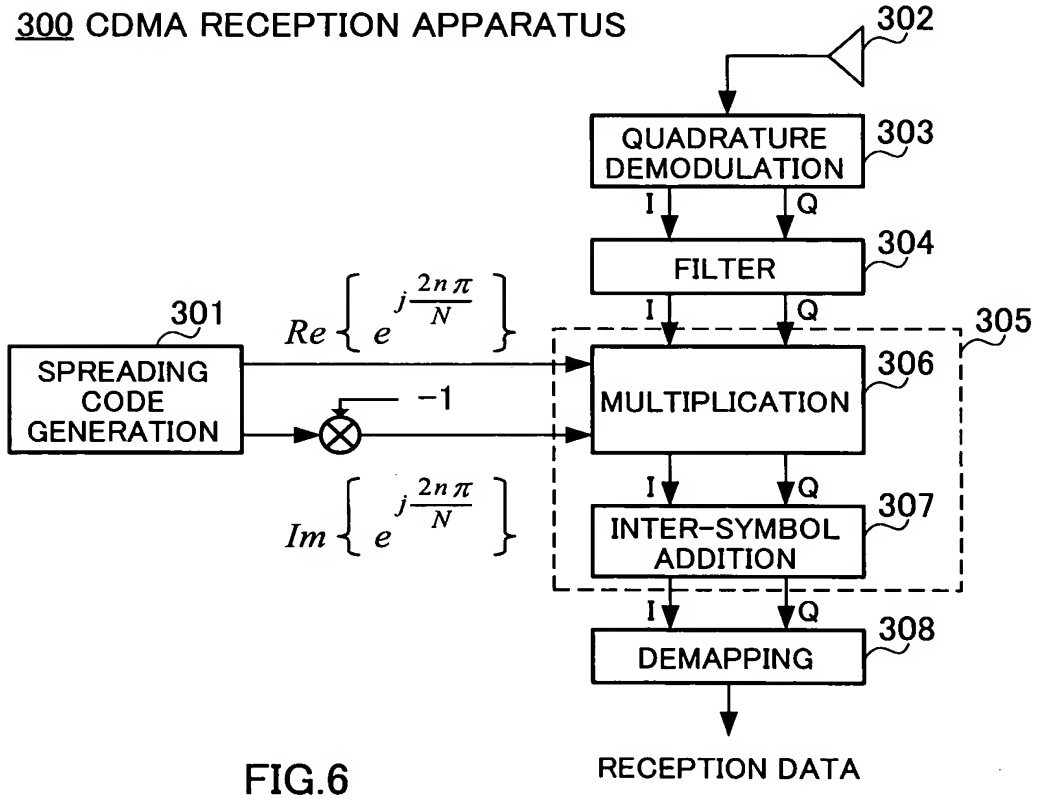
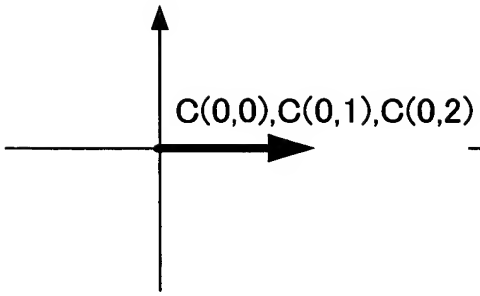
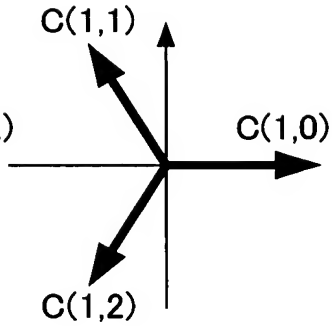

300 CDMA RECEPTION APPARATUS
302
QUADRATURE DEMODULATION
303
FILTER
304
301
SPREADING CODE GENERATION
Re
Im
−1
305
MULTIPLICATION
306
INTER-SYMBOL ADDITION
307
DEMAPPING
308
RECEPTION DATA

FIG.6



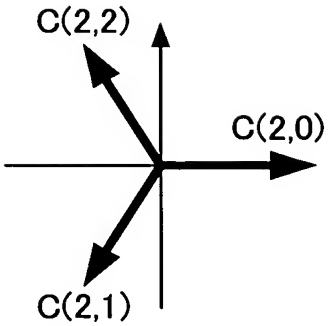
SPREADING
CODE 0
(a=0)

FIG.7A



SPREADING
CODE 1
(a=1)

FIG.7B



SPREADING
CODE 2
(a=2)

FIG.7C

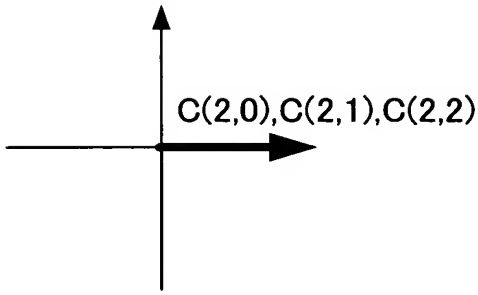


FIG.8A

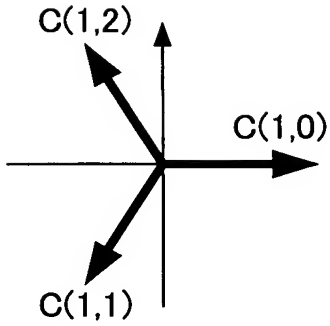


FIG.8B

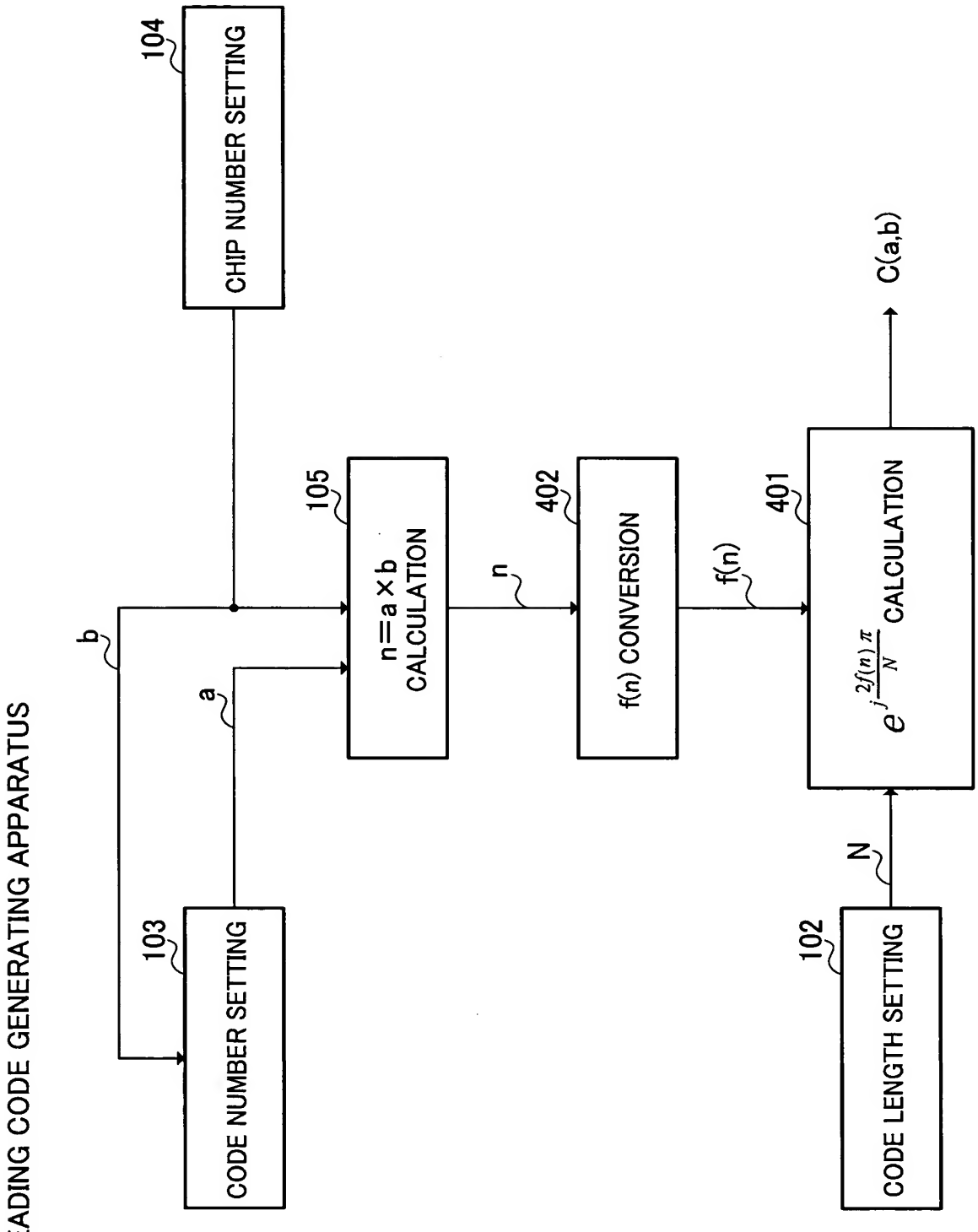

400 SPREADING CODE GENERATING APPARATUS
104
CHIP NUMBER SETTING
105
n=a×b CALCULATION
402
f(n) CONVERSION
401
$e^{j\frac{2f(n)\pi}{N}}$ CALCULATION
C(a,b)
n
f(n)
b
a
103
CODE NUMBER SETTING
102
CODE LENGTH SETTING
N

FIG.9

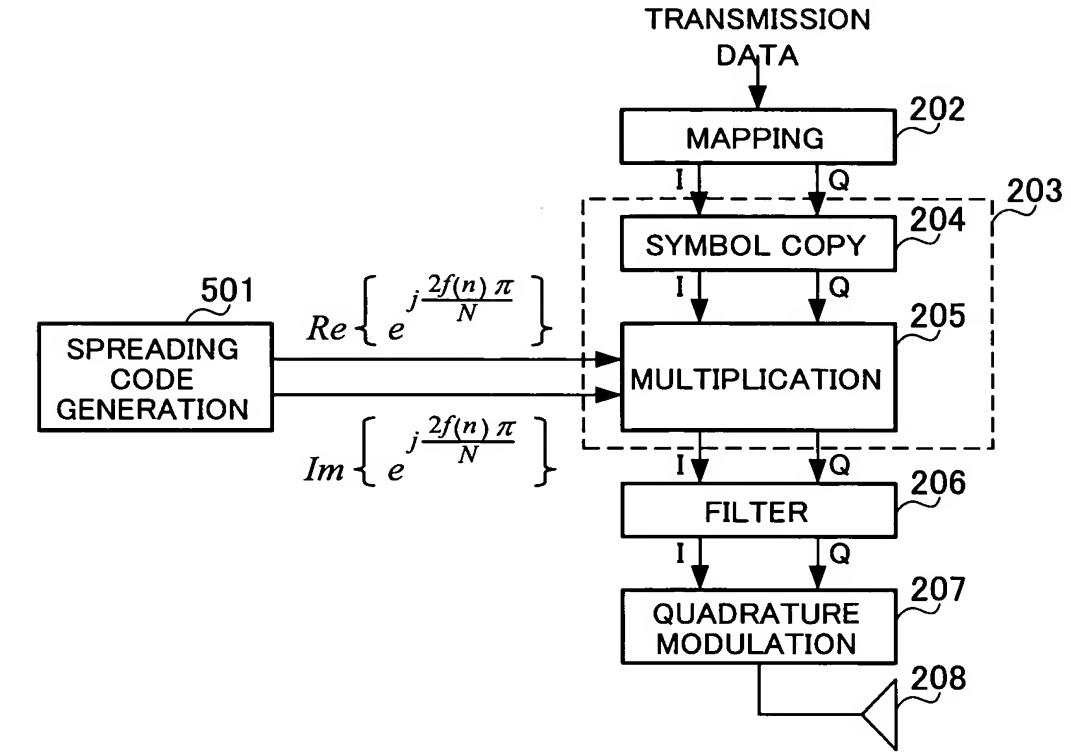

500 CDMA TRANSMISSION APPARATUS
TRANSMISSION DATA
MAPPING
202
I
Q
203
SYMBOL COPY
204
501
SPREADING CODE GENERATION
Re
Im
MULTIPLICATION
205
FILTER
206
QUADRATURE MODULATION
207
208

FIG.10

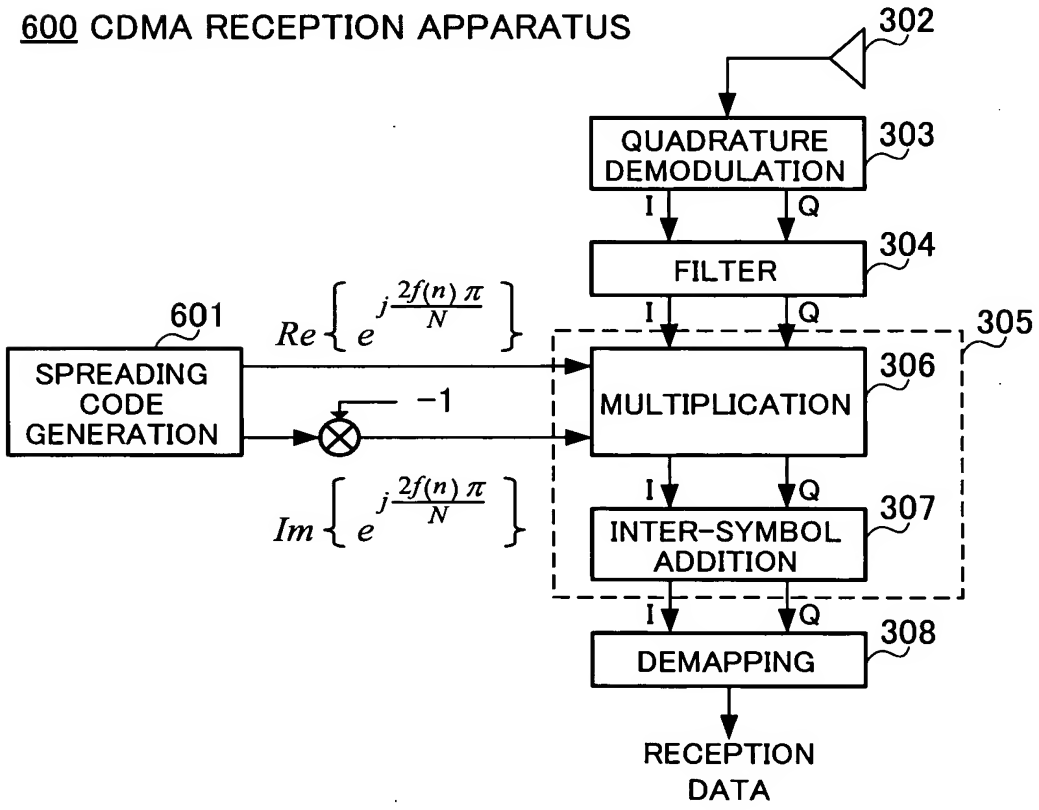

600 CDMA RECEPTION APPARATUS
302
QUADRATURE DEMODULATION
303
FILTER
304
601
SPREADING CODE GENERATION
Re
Im
−1
MULTIPLICATION
305
306
INTER-SYMBOL ADDITION
307
DEMAPPING
308
RECEPTION DATA

FIG.11

700 CDMA TRANSMISSION APPARATUS

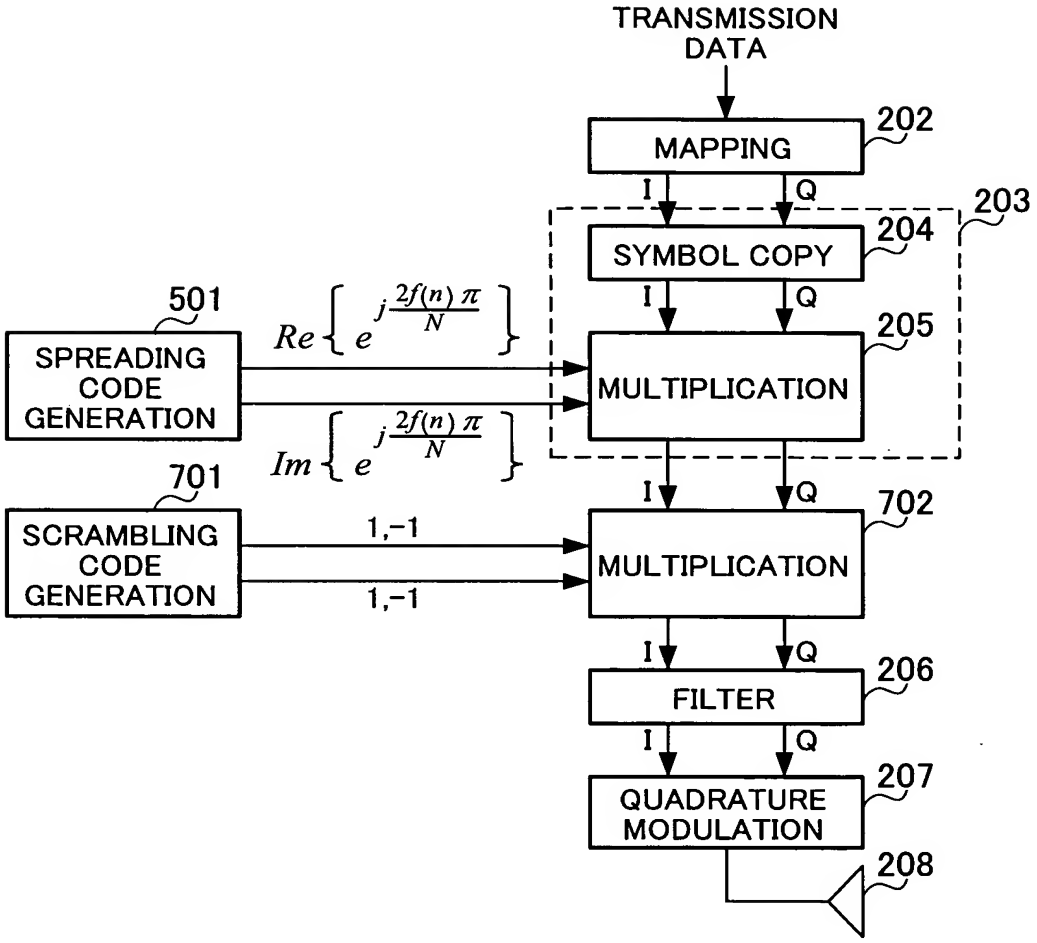


FIG.12

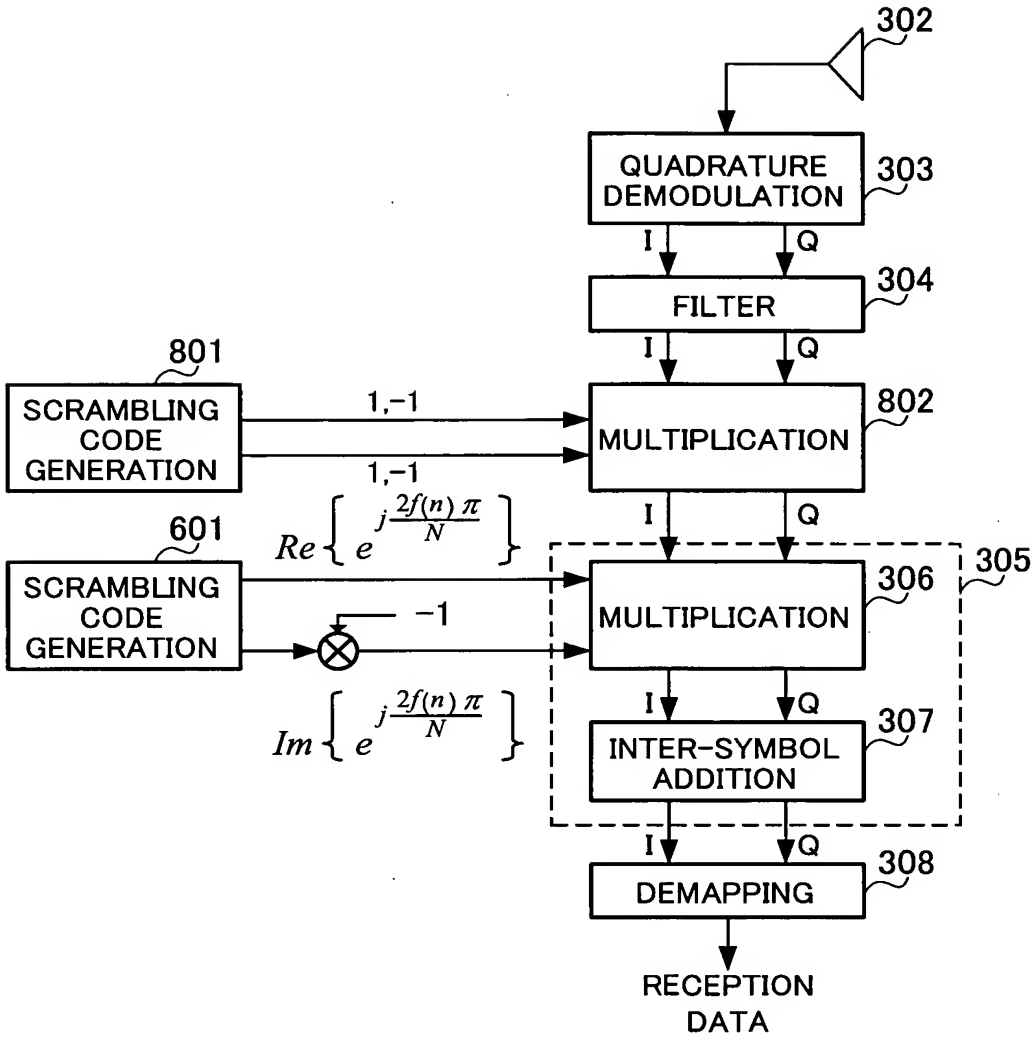

800 CDMA RECEPTION APPARATUS
302
QUADRATURE DEMODULATION
303
I
Q
FILTER
304
801
SCRAMBLING CODE GENERATION
1,-1
1,-1
MULTIPLICATION
802
601
SCRAMBLING CODE GENERATION
Re { e^{j 2f(n) π / N} }
-1
Im { e^{j 2f(n) π / N} }
MULTIPLICATION
306
305
INTER-SYMBOL ADDITION
307
DEMAPPING
308
RECEPTION DATA

FIG.13

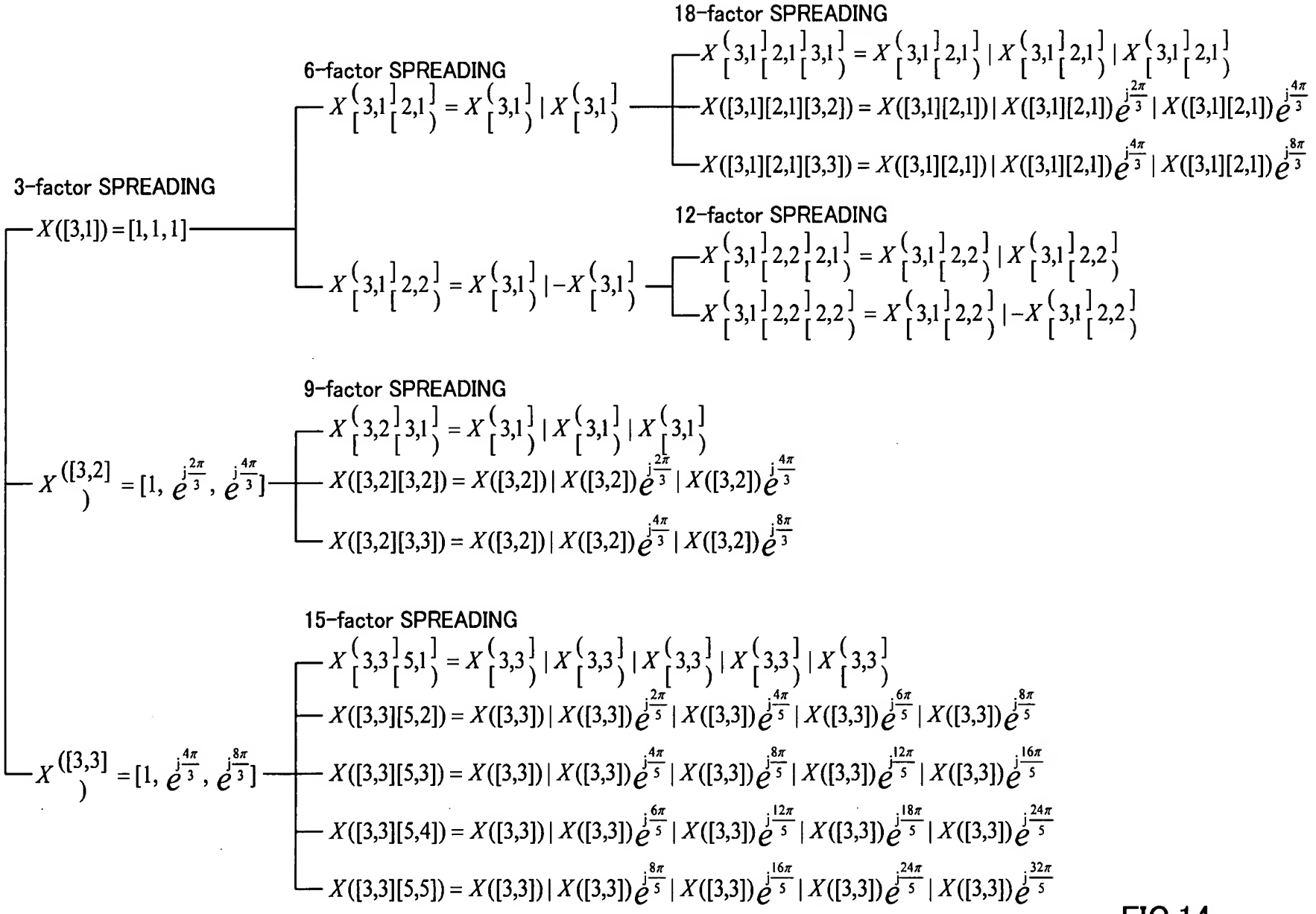

3-factor SPREADING
$X([3,1]) = [1,1,1]$
$X([3,2]) = [1, e^{j\frac{2\pi}{3}}, e^{j\frac{4\pi}{3}}]$
$X([3,3]) = [1, e^{j\frac{4\pi}{3}}, e^{j\frac{8\pi}{3}}]$
6-factor SPREADING
$X_{[3,1][2,1]} = X_{[3,1]} | X_{[3,1]}$
$X_{[3,1][2,2]} = X_{[3,1]} | -X_{[3,1]}$
18-factor SPREADING
$X_{[3,1][2,1][3,1]} = X_{[3,1][2,1]} | X_{[3,1][2,1]} | X_{[3,1][2,1]}$
$X([3,1][2,1][3,2]) = X([3,1][2,1]) | X([3,1][2,1]) e^{j\frac{2\pi}{3}} | X([3,1][2,1]) e^{j\frac{4\pi}{3}}$
$X([3,1][2,1][3,3]) = X([3,1][2,1]) | X([3,1][2,1]) e^{j\frac{4\pi}{3}} | X([3,1][2,1]) e^{j\frac{8\pi}{3}}$
12-factor SPREADING
$X_{[3,1][2,2][2,1]} = X_{[3,1][2,2]} | X_{[3,1][2,2]}$
$X_{[3,1][2,2][2,2]} = X_{[3,1][2,2]} | -X_{[3,1][2,2]}$
9-factor SPREADING
$X_{[3,2][3,1]} = X_{[3,1]} | X_{[3,1]} | X_{[3,1]}$
$X([3,2][3,2]) = X([3,2]) | X([3,2]) e^{j\frac{2\pi}{3}} | X([3,2]) e^{j\frac{4\pi}{3}}$
$X([3,2][3,3]) = X([3,2]) | X([3,2]) e^{j\frac{4\pi}{3}} | X([3,2]) e^{j\frac{8\pi}{3}}$
15-factor SPREADING
$X_{[3,3][5,1]} = X_{[3,3]} | X_{[3,3]} | X_{[3,3]} | X_{[3,3]} | X_{[3,3]}$
$X([3,3][5,2]) = X([3,3]) | X([3,3]) e^{j\frac{2\pi}{5}} | X([3,3]) e^{j\frac{4\pi}{5}} | X([3,3]) e^{j\frac{6\pi}{5}} | X([3,3]) e^{j\frac{8\pi}{5}}$
$X([3,3][5,3]) = X([3,3]) | X([3,3]) e^{j\frac{4\pi}{5}} | X([3,3]) e^{j\frac{8\pi}{5}} | X([3,3]) e^{j\frac{12\pi}{5}} | X([3,3]) e^{j\frac{16\pi}{5}}$
$X([3,3][5,4]) = X([3,3]) | X([3,3]) e^{j\frac{6\pi}{5}} | X([3,3]) e^{j\frac{12\pi}{5}} | X([3,3]) e^{j\frac{18\pi}{5}} | X([3,3]) e^{j\frac{24\pi}{5}}$
$X([3,3][5,5]) = X([3,3]) | X([3,3]) e^{j\frac{8\pi}{5}} | X([3,3]) e^{j\frac{16\pi}{5}} | X([3,3]) e^{j\frac{24\pi}{5}} | X([3,3]) e^{j\frac{32\pi}{5}}$

FIG.14

900 CDMA TRANSMISSION APPARATUS

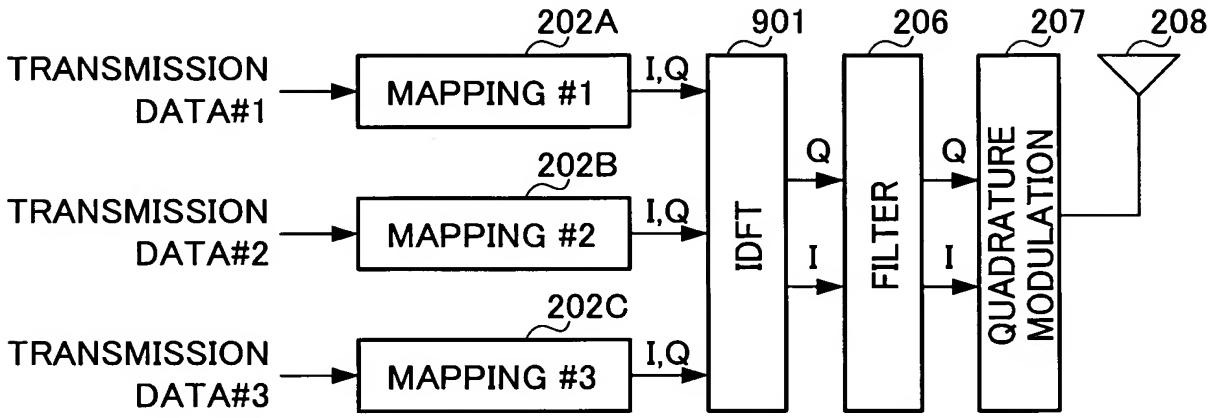


FIG.15

1000 CDMA RECEPTION APPARATUS

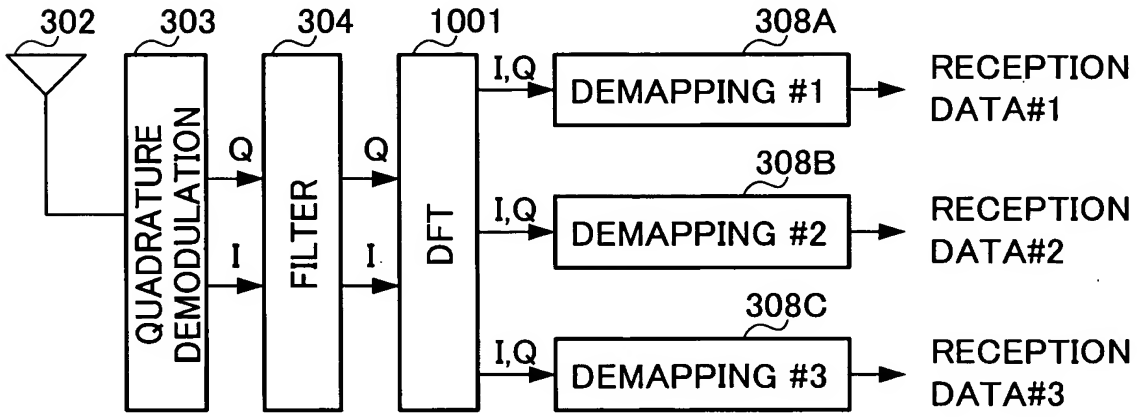


FIG.16

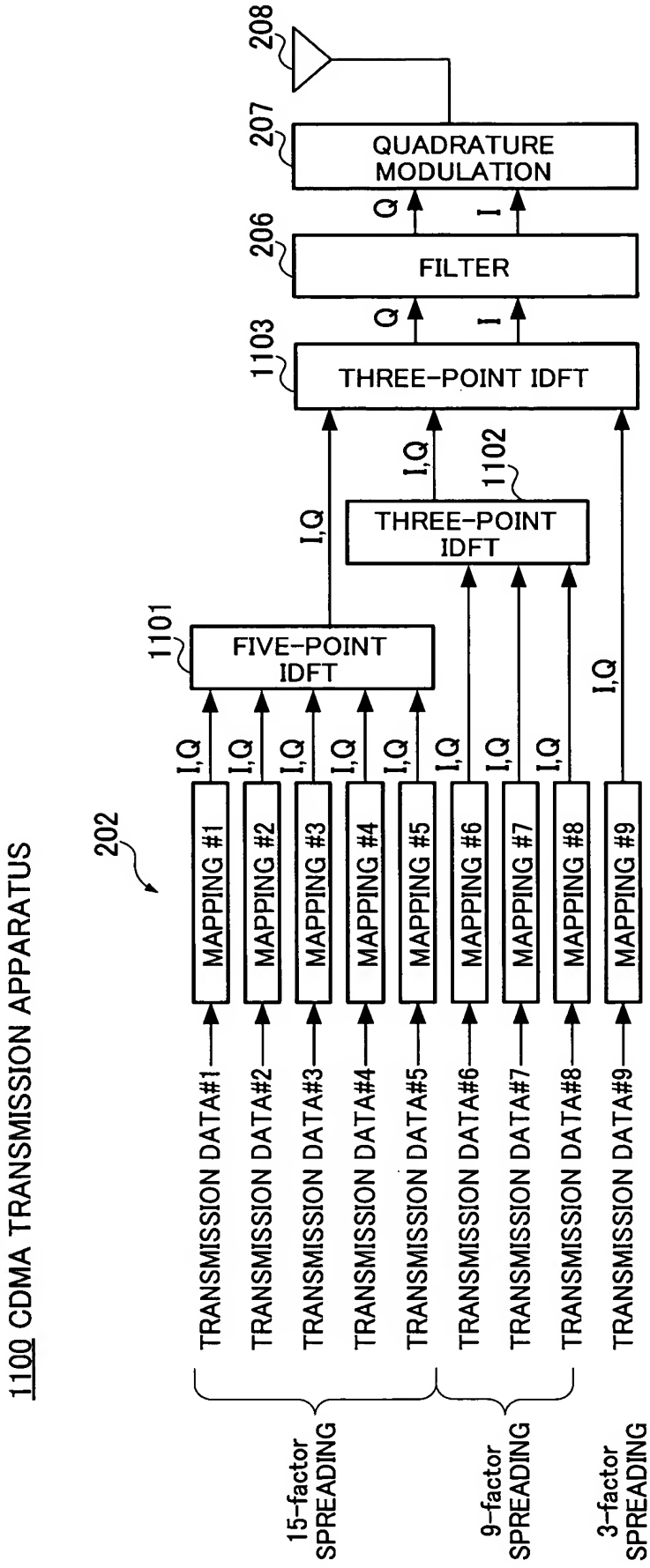

1100 CDMA TRANSMISSION APPARATUS
202
TRANSMISSION DATA#1
TRANSMISSION DATA#2
TRANSMISSION DATA#3
TRANSMISSION DATA#4
TRANSMISSION DATA#5
TRANSMISSION DATA#6
TRANSMISSION DATA#7
TRANSMISSION DATA#8
TRANSMISSION DATA#9
MAPPING #1
MAPPING #2
MAPPING #3
MAPPING #4
MAPPING #5
MAPPING #6
MAPPING #7
MAPPING #8
MAPPING #9
I,Q
1101
FIVE-POINT IDFT
1102
THREE-POINT IDFT
1103
THREE-POINT IDFT
Q
I
206
FILTER
207
QUADRATURE MODULATION
208
15-factor SPREADING
9-factor SPREADING
3-factor SPREADING

FIG.17

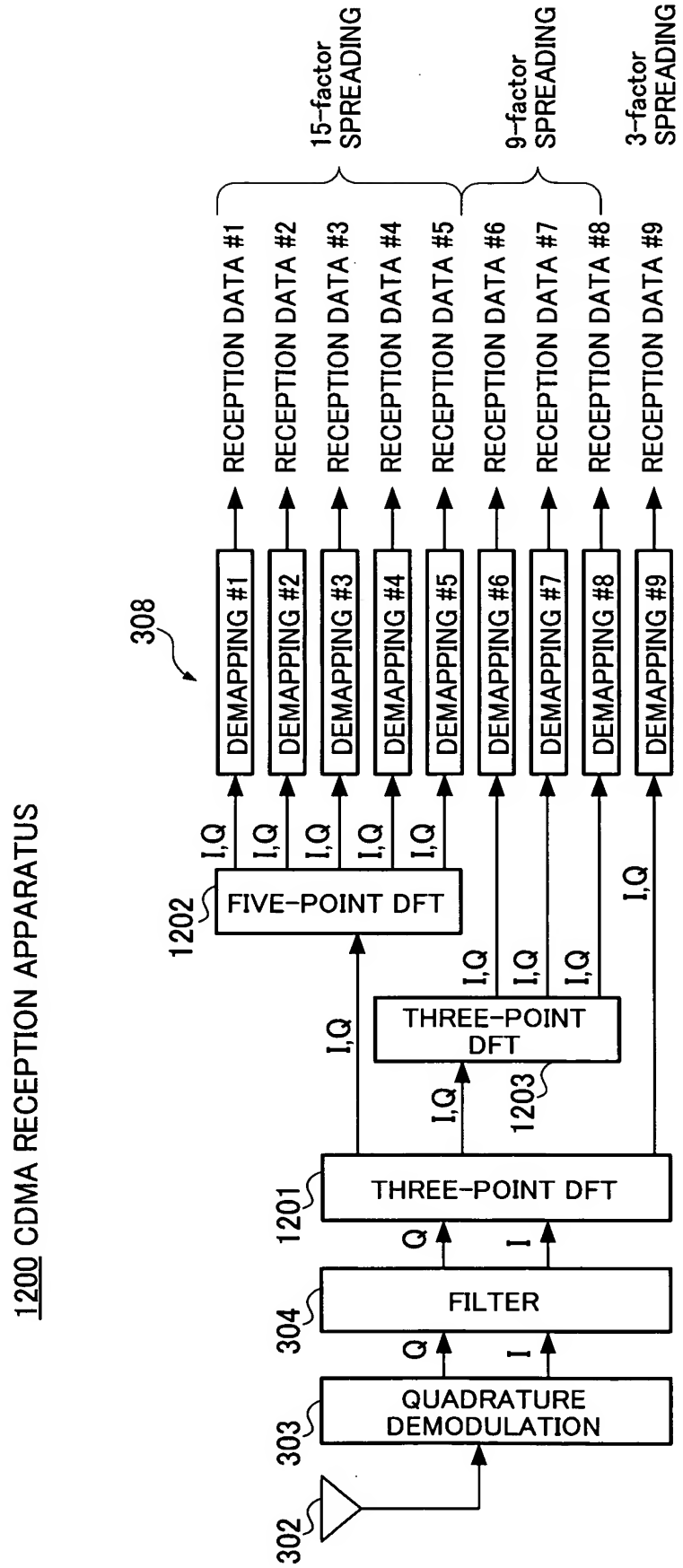

1200 CDMA RECEPTION APPARATUS
302
303
QUADRATURE DEMODULATION
304
FILTER
Q
I
1201
THREE-POINT DFT
1203
THREE-POINT DFT
1202
FIVE-POINT DFT
I,Q
308
DEMAPPING #1
DEMAPPING #2
DEMAPPING #3
DEMAPPING #4
DEMAPPING #5
DEMAPPING #6
DEMAPPING #7
DEMAPPING #8
DEMAPPING #9
RECEPTION DATA #1
RECEPTION DATA #2
RECEPTION DATA #3
RECEPTION DATA #4
RECEPTION DATA #5
RECEPTION DATA #6
RECEPTION DATA #7
RECEPTION DATA #8
RECEPTION DATA #9
15-factor SPREADING
9-factor SPREADING
3-factor SPREADING

FIG.18